Traffic Congestion in the SouthWest Advisory Planning Subregion

Issues and Potential Responses

Sherborn Town Center Traffic Flow Improvement Study

Route 16 in Milford Town Center: Traffic Signal Retiming Study

A report produced by the Central Transportation Planning Staff for the Boston Metropolitan Planning Organization

Traffic Congestion in the SouthWest Advisory Planning Subregion

Issues and Potential Responses

Sherborn Town Center Traffic Flow Improvement Study

Route 16 in Milford Town Center: Traffic Signal Retiming Study

Project Manager
Selh Asante

Data Analysis
Kate Wall

Geographic Information Systems
Kathy Jacob

Graphics
Kate Parker
Kenneth A. Dumas

Cover Design
Jane M. Gillis

The preparation of this document was supported by the Massachusetts Highway Department (MassHighway) and Federal Highway Administration through MassHighway Agreements 30048, 31018, **and** 32057,

Central Transportation Planning Staff
Directed by the Boston Metropolitan Planning Organization. The MPO is composed of state and regional agencies and authorities, and local governments,

October 2002

This document is available in **accessible formats.**

For additional copies of this document, or **to** request it in **an accessible format, contact:**

Seth Asante, Project Manager

Central **Transportation** Planning Staff
10 **Park Plaza, Suite 2150**
Boston, Massachusetts 02116

(617)973-7098
(617) 973-8855 (fax)
(617) 973-7089 (TTY)

seth.asante@ctps.org

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

INTRODUCTION

This study originated from the Boston Metropolitan Planning Organization’s Congestion Management System (CMS) program, which identified the SouthWest Advisory Planning Committee (SWAP) subregion as experiencing significant traffic growth, and congestion and safety problems. The purpose of this study has been to provide a complete overview of the subregion's congestion problems and to identify additional steps that should be taken to address them.

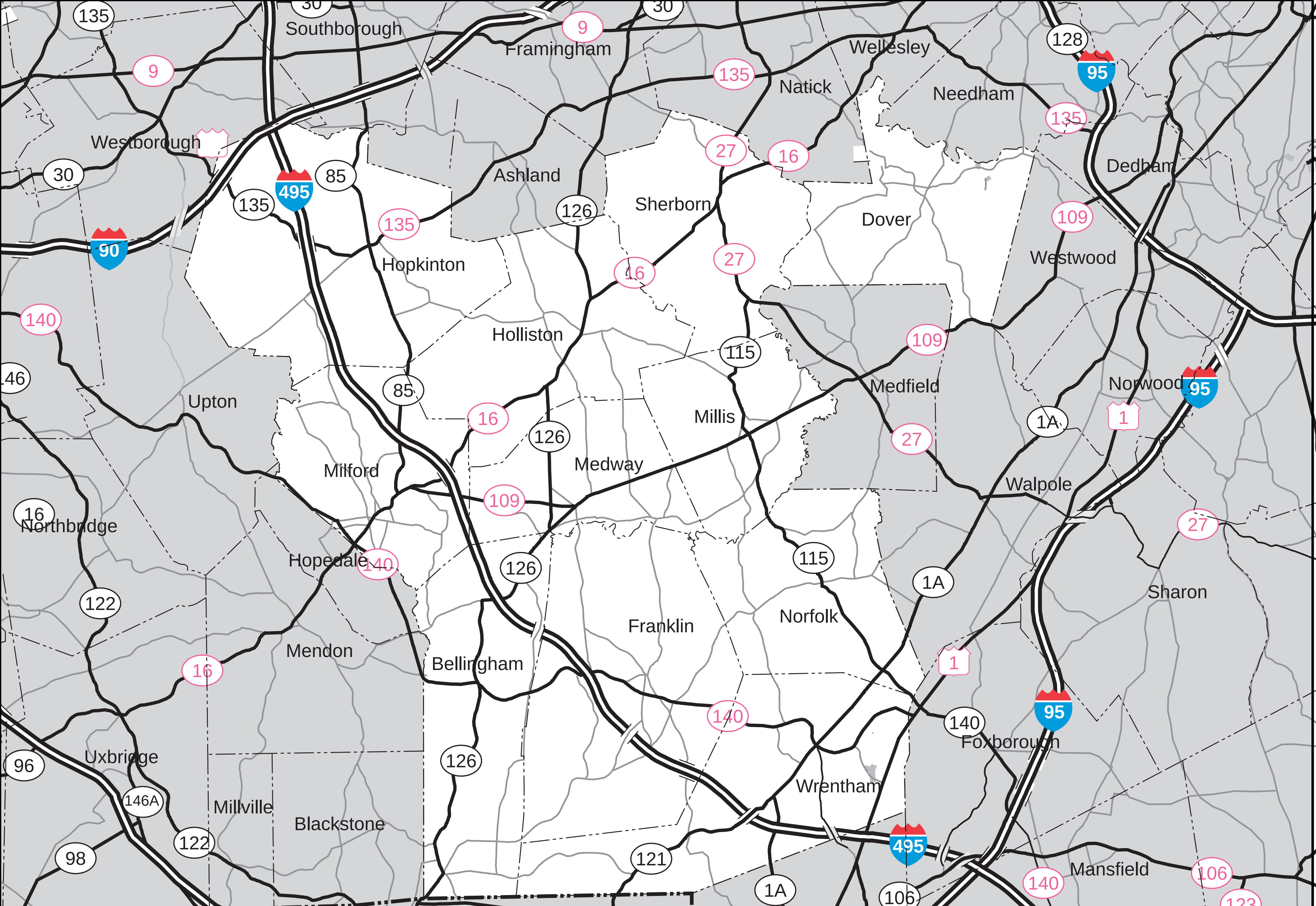
The subregion contains 11 towns: Bellingham, Dover, Franklin, Holliston, Hopkinton, Medway, Milford, Millis, Norfolk, Sherborn, and Wrentham (Figure ES-1). The member towns favor cooperative planning and a subregional approach to improving SWAP’s transportation system, including its highways, transit, and park-and-ride lots. The towns feel that the subregion’s critical roadways have not received an appropriate level of planning attention over the years.

This study had two phases, both of which are documented in this report. The first phase, which is reported in chapter 2 “ Issues and Potential Responses,” examined the socioeconomic and transportation conditions and trends in the subregion, identified the locations of congestion and mobility problems, inventoried the current initiatives at those locations, and developed a list of potential CTPS studies to address problem locations where currently there are no project initiatives. From the list of potential studies, the SWAP Committee selected two for study for the second phase of this study: the Sherborn Town Center Traffic Flow Improvement Study, which is reported in chapter 3, and Route 16 in Milford Town Center: Traffic Signal Retiming Study, which is reported in chapter 4.

ISSUES AND POTENTIAL RESPONSES

The majority of the problems in SWAP that are described in this study were identified through detailed CMS monitoring and via numerous comments received from the SWAP communities. Many of the problems are related to the recent expansion of industrial and commercial development along the I-495 corridor and in the MetroWest area: SWAP roadways that carry the bulk of the traffic accessing those employment centers have become congested during peak periods. The impact of this growth in traffic is most evident at the major intersections, where long delays are common.

None of the towns in this subregion operates a bus service. Six are not affiliated with a regional transit authority (Bellingham, Franklin, Holliston, Hopkinton, Medway, and Wrentham). Five are affiliated with the Massachusetts Bay Transportation Authority (MBTA)—Dover, Millis, Milford, Norfolk, and Sherborn are served by the MBTA’s Franklin Line commuter rail. The SWAP Committee is supportive of expanded public transportation services for the subregion and has expressed interest in using transit and transportation demand management in addressing traffic congestion, mobility problems, and safety problems. For example, the subregion has been a strong advocate of shuttle bus service between train stations and employment centers.



C T P S

Traffic Congestion in the SouthWest Advisory Planning Subregion

FIGURE ES-1
SouthWest Advisory Planning Committee Subregion

Traffic flows on most SWAP roadways are interrelated and span multiple towns. There is a desire in the communities to avoid solutions that would involve significant additions to roadway capacity with associated land-takings and environmental impacts. The suitable methods of managing congestion are likely to be improvements at critical locations that will produce maximum regional benefits, accompanied by increased transit service, the building of new park-and-ride lots, and increasing the capacity of the Massachusetts Bay Transportation Authority lots.

Socioeconomic Trends

For all three demographics (employment, population, and households), SWAP is forecast by the Metropolitan Area Planning Council (MAPC) to be the fastest-growing of the Boston Metropolitan Planning Organization (MPO) subregions between 1990 and 2020, experiencing about 58% growth in employment, 40% in population, and 50% in households. The growth in SWAP is fueled by the high quality of life that its communities offer and by other factors. The subregion's high rate of employment growth is expected to continue in part because the intensive development of Boston's inner core and the Route 128 corridor has resulted in land shortages, rising prices, and traffic congestion that have led business decision-makers to look to the I-495 corridor. In addition, the improved business climate, changing local attitudes, and strong interest in economic growth that are present in the corridor, and the excellent transportation and access provided by I-495, are attracting developers.

The socioeconomic forecasts for SWAP assume that some towns will make amendments to their zoning bylaws in order to allow further growth, the benefits of which include expansion of the tax base. Because of growth management issues in the I-495 corridor, the I-495 Technology Corridor Initiative/Campaign for Shared Solutions was initiated to create a shared vision for the future that balances appropriate economic development with the quality of life, and to outline the steps to realize the vision. This initiative serves as a regional forum at which representatives of the cities and towns and businesses discuss these issues, including transportation-related issues.

The increases in jobs, population, and households are expected to directly result in increased commuter and local traffic on the major roadways, and efforts must be made to improve the roadway system's capability of handling higher traffic volumes and to increase the use of such transportation modes as commuter rail, carpool/vanpool, and bus.

Transportation

Highway

SWAP is served by different classes of roadway that provide through-traffic movement and land access. The roadways fall primarily into two jurisdictions: town and MassHighway. The majority of the arterials and collectors are town-owned, two-way roadways, and two-lane except at the major intersections where they are widened to accommodate turn bays. The volumes of traffic along each roadway show considerable variation due to traffic interchange and interconnections of the major arterials. The major roadways have a regional impact, not only because they span many towns, but also because they are dependent on one another to provide efficient transportation. Evidence of their interdependence can be seen in the many overlaps and splits

(Routes 16/126, Routes 16/109, and Route 16/27) and major intersections (Routes 109 and 126, Routes 126 and 140, Routes 109 and 115, and Routes 16 and 140) in the SWAP subregion.

I-495 is the major highway in SWAP showing the most dramatic growth in traffic. All of its sections from Wrentham to Hopkinton are experiencing traffic growth. Average weekday traffic over the period from 1977 to 1997 grew over 300% on most sections, and some sections are operating at 75% of practical daily capacity. While there has been consistent growth in traffic on I-495, the trends of the historical traffic volumes on the major arterials are mixed. Some arterial segments have been experiencing tremendous growth in traffic, while on others volumes have remained practically constant. The latter segments are locations that have severe congestion and insufficient capacity to handle traffic demand during the peak periods. At these locations, the additional traffic demand, instead of increasing the overall traffic volumes, has rather led to spreading of the peak period and diversion of traffic onto collector streets.

Transit/Paratransit

- Commuter Rail

The Franklin commuter rail line, which provides service to Back Bay Station and South Station in Boston, is the primary transit route serving the SWAP subregion. There are two stations on that line in Franklin and one in Norfolk. Residents of Sherborn and Holliston are near stations on the Framingham/Worcester Line. Residents of Dover are near stations on the two lines mentioned and on the Needham and Attleboro/Providence lines. All of the park-and-ride lots at the stations in or near SWAP are usually full by 7:30 A.M., except the lot at Route 128 Station on the Attleboro/Providence Line. As of the 1990 census, commuter rail was used by 2.7% of the commuters from SWAP.

- Bus

None of the SWAP towns operates a bus service. All of the bus transit services operating within the SWAP subregion either are provided by private carrier or are an extension of services from the MetroWest area. In Medway, Millis, and Milford, Brush Hill Transportation provides rush-hour commuter bus transit service to and from Boston on workdays along Route 109. There is also a service from Milford to Framingham that connects with Boston buses and trains. The LIFT, a local service operated by the Town of Framingham, usually on a headway of one or two hours, provides service to the malls on Route 9, the Framingham Technology Center, the local medical centers, and the Framingham town center. There are six routes on the LIFT system, two of which serve Holliston and Hopkinton. The daily ridership on each of the LIFT routes is in the range of 40–120 passengers.

- Shuttle Systems

There are no public shuttles in the SWAP subregion that connect major employment centers to commuter rail stations and park-and-ride lots. The existing shuttles are employer-specific systems that are designed to move employees from one office site to another and are not shared between employers or the public. The formation of shuttle bus systems to move commuters from

stations and park-and-ride lots to the major employment centers and the eventual expansion of these services to include medium-size employment centers would enhance the transportation demand management program in SWAP and reduce the use of single-occupant vehicles. The availability of ample parking at major employment centers in SWAP is an important limiting factor for the successful implementation of shuttle systems.

- Park-and-Ride Lots

Park-and-ride lots are discussed in this section because of their direct link with public transportation. Only one park-and-ride lot in SWAP serves bus transit to Boston, the lot in Milford at the intersection of Route 16 and Beach Street. A recent CTPS study conducted for MassHighway investigated potential sites throughout the Boston region for building new park-and-ride lots to serve bus transit, carpools and vanpools, and shuttles.[1] That study evaluated a number of locations for new MassHighway park-and-ride lots suggested by regional planning agencies, CARAVAN, private bus companies, various MAPC subregional advisory groups, and respondents to a park-and-ride-lot questionnaire. The final list includes three possible locations in SWAP: two in Milford, at I-495 exits 19 and 20, and one in Hopkinton, at I-495 exit 21. Another possible location recommended by the study that would be beneficial to the SWAP communities is Route 128 exit 16, at the Westwood/Dedham town line, where Route 109 crosses Route 128.

Work Trips

Looking at the distribution of destinations by Boston-area subregion of journey-to-work trips from SWAP: SWAP itself accounts for a large portion of the destinations, and so do the MetroWest, Inner Core, and TRIC subregions. The growth in jobs in the SWAP subregion and in other subregions is expected to increase journey-to-work trips with both origin and destination within SWAP as well as those with only origin or destination within SWAP.

Most commuters from SWAP drive alone to work, a small percentage carpool and other modes are used by still smaller percentages of the commuters. Analysis at the town level shows a similar distribution. Only commuters to the Inner Core area use commuter rail and other transit modes to any significant extent, as most of the other subregions are not easily accessible by these modes. Dover, Franklin, Norfolk, and Sherborn are the towns with the highest densities of commuter rail share; they have the best access to commuter rail stations or park-and-ride lots.

While there has been significant growth in employment since the 1990 census, which is the source of this information on work trips, that growth presumably has not affected mode shares significantly, because of the nature of the subregion's transportation system.

Current Initiatives and Responses

Congested locations in SWAP were identified by examining CMS monitoring results, planning studies, and comments received from the SWAP communities. It was then ascertained for each location whether any improvement project or planning study has already been proposed or initiated that would address the location's problems. The two primary aspects of accomplishing

[1] "MassHighway Park-and-Ride Lot Study, Phase I-III", CTPS memoranda, on going.

this were examination of the Transportation Improvement Program, and review of past work by the towns and CTPS.

The congestion-problem locations that are not yet being addressed were evaluated to determine what kind of study is called for in each case. The potential studies that were thus identified are listed in Figures ES-2 through ES-7. Crash data for the locations was examined in addition to congestion-related data; some of the potential studies aim at improving safety along with mobility. The list of studies will be updated periodically as part of the Congestion Management System process and to address any new issues or problem locations identified through continuing communication with the SWAP communities.

SHERBORN TOWN CENTER TRAFFIC FLOW IMPROVEMENT STUDY

The study area encompasses nearly 1.5 miles of Routes 16 and 27 in Sherborn's town center. Most of the intersections in the study area were analyzed. All of the roadways are two-way, two-lane streets under the jurisdiction of the Town. The primary issue is the high volume of commuter traffic on Routes 16 and 27 during the peak periods, which causes long delays and queues in the town center. This congestion affects the safety of pedestrians and motorists and access from the side streets. Both MassHighway and the Town of Sherborn are concerned about these problems and are looking for solutions that will promote safety and traffic flow while maintaining the town's village atmosphere.

Existing Conditions

The existing conditions with regard to traffic operations and safety at the study intersections and on the roadway segments between them were investigated through field reconnaissance and through analysis of data on traffic and crashes. The analysis also included forecasting traffic volumes for 2020. In summary, the existing-conditions analysis indicated that:

1. Both the North and South Splits (the convergence points of Route 16 and Route 27) are congested. See Figure ES-7 for the locations of the North and South Splits.

2. Of the side streets that were analyzed most experience unacceptable delays during one or both peak periods: Powderhouse Lane, Cemetery Lane, Maple Street, Sanger Street at Route 16, Sawin Street at Route 27, and Farm Road.

3. Analysis of crash data indicated that the location with the highest crash rate is the Maple Street/Sanger Street intersection; the South Split is the second highest crash location.

4. Three of the unsignalized intersections in the study area met Warrants 2 and 3 of the traffic signal warrants: the South Split, Route 16 at Maple Street/Sanger Street, and Route 27 at Sawin Street. These two warrants indicate that traffic on the minor street suffers undue delay in entering or crossing the major street. The North Split traffic signal also met Warrants 2 and 3. An engineering study indicates that at those unsignalized intersections that met Warrants 2 and 3, installing a traffic signal would improve the overall safety and traffic operations of the intersections.

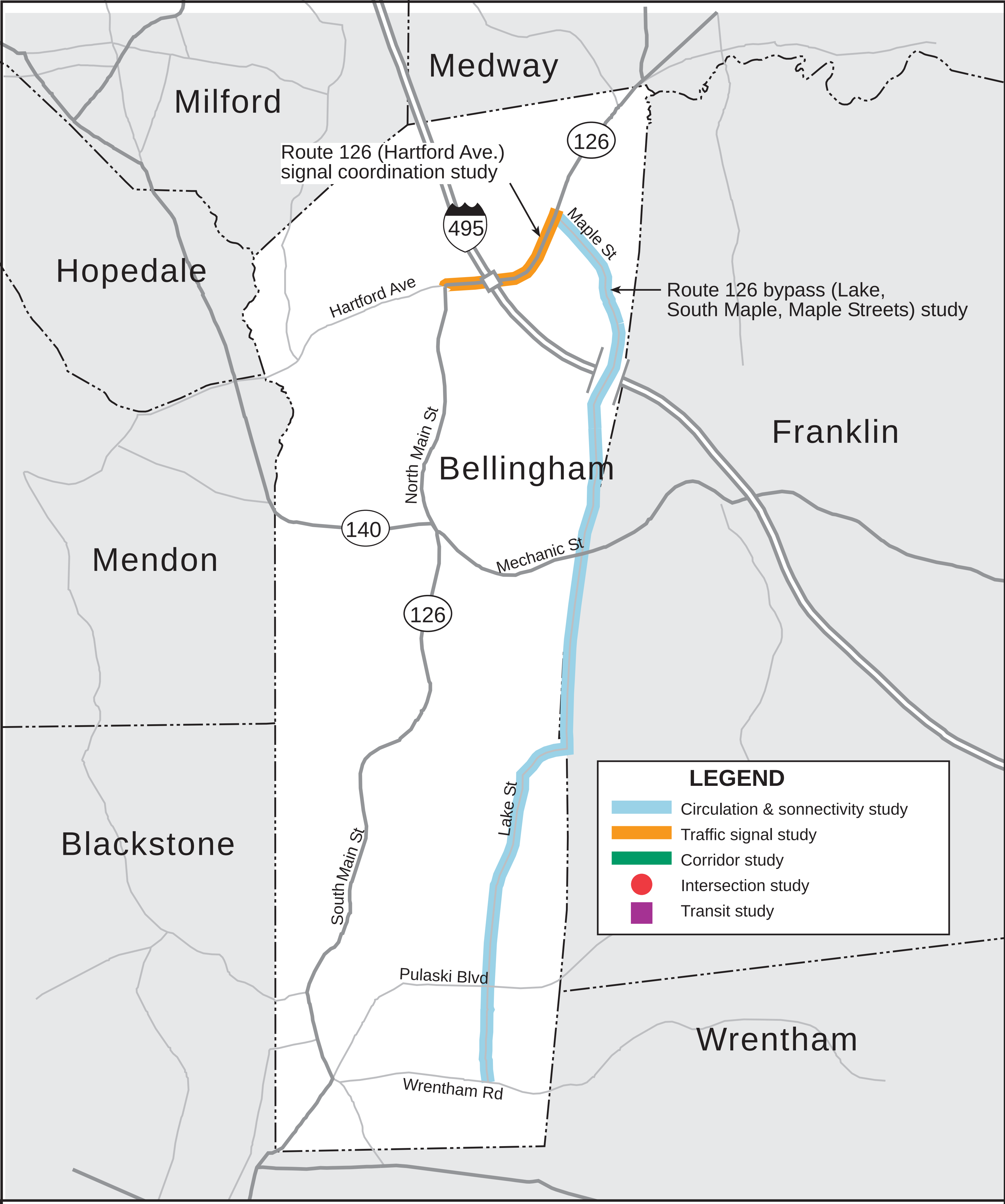


FIGURE ES-2
Bellingham: Potential Studies

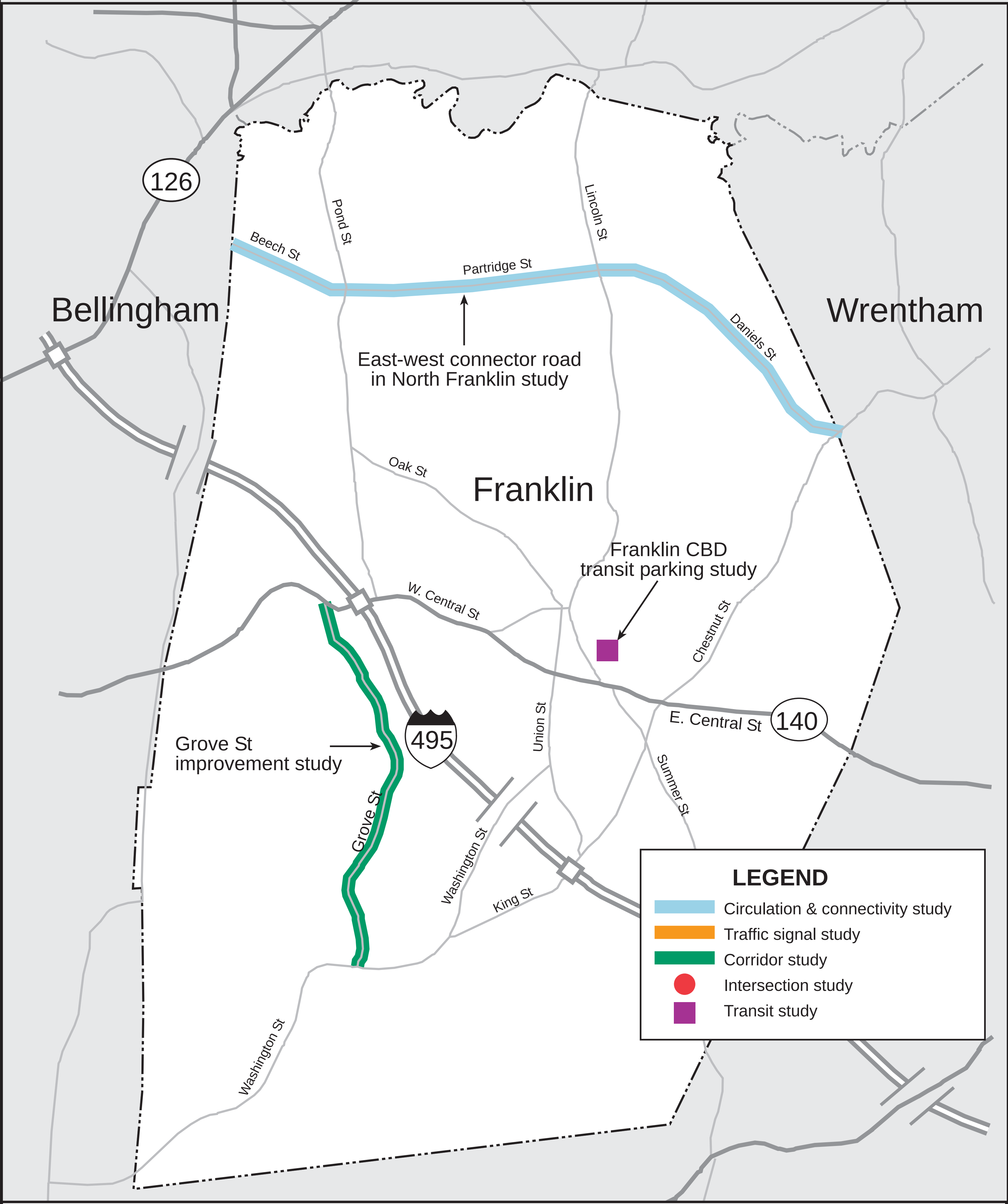


FIGURE ES-3

Franklin: Potential Studies

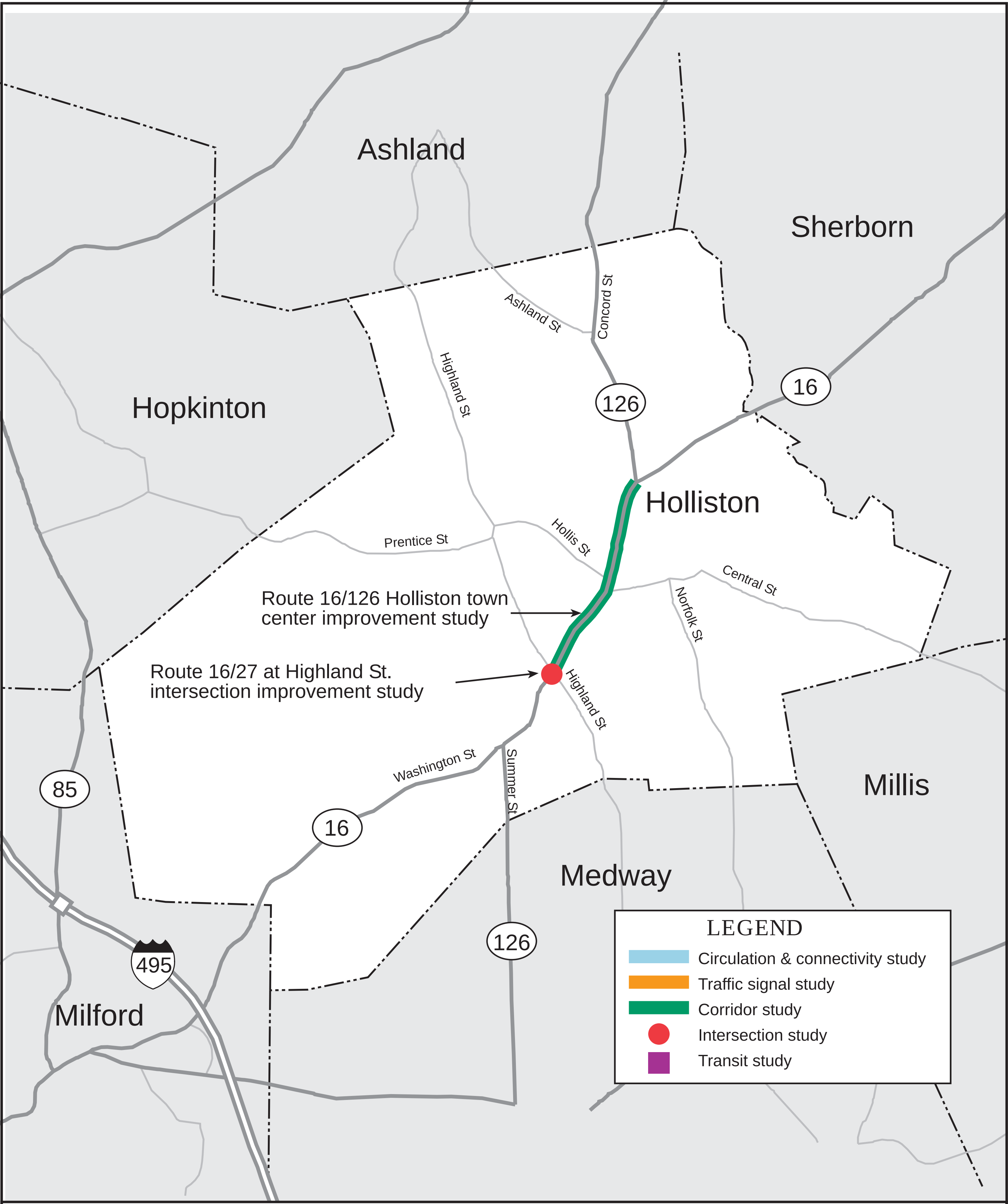


FIGURE ES-4

Holliston: Potential Studies

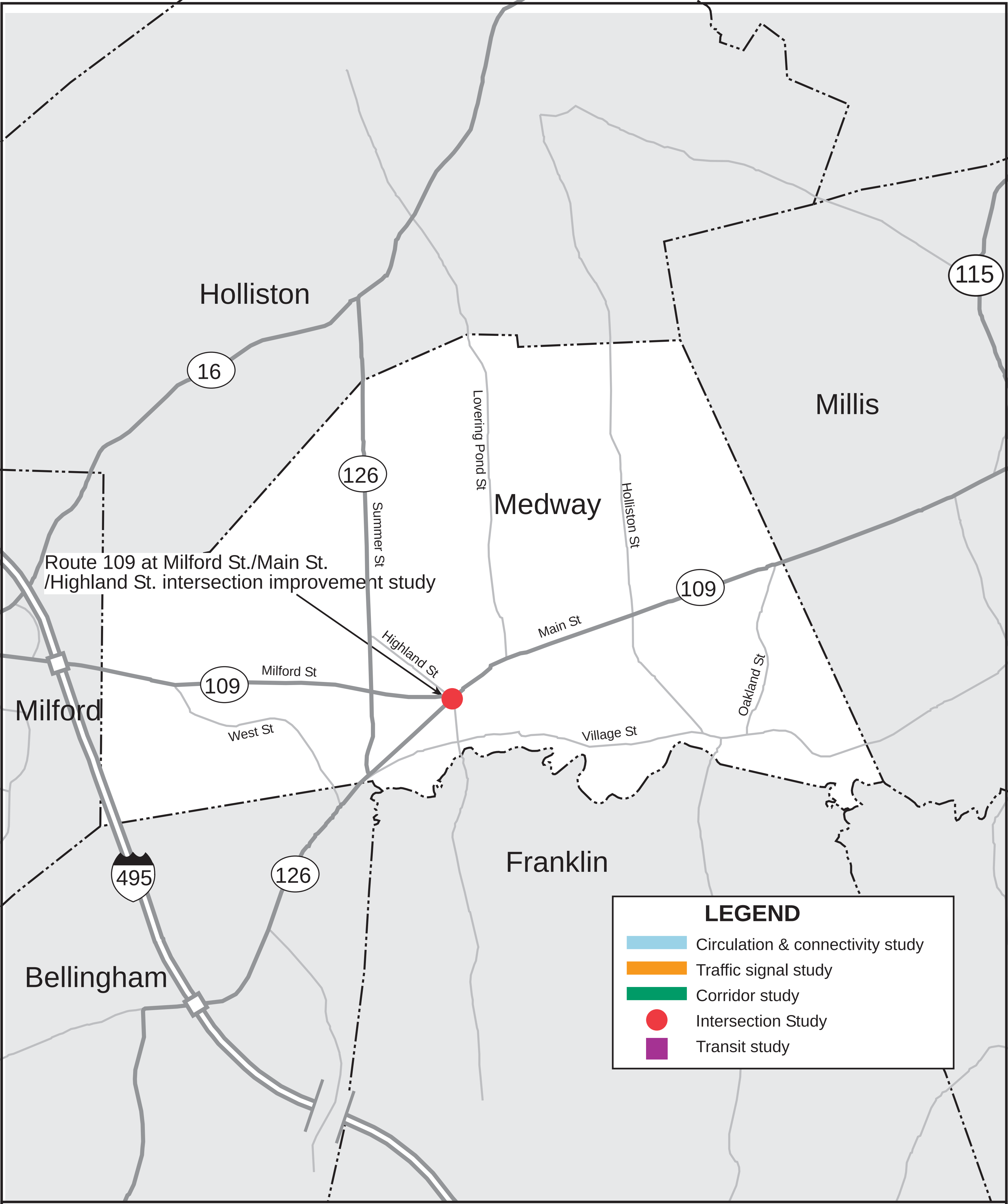


FIGURE ES-5

Medway: Potential Study

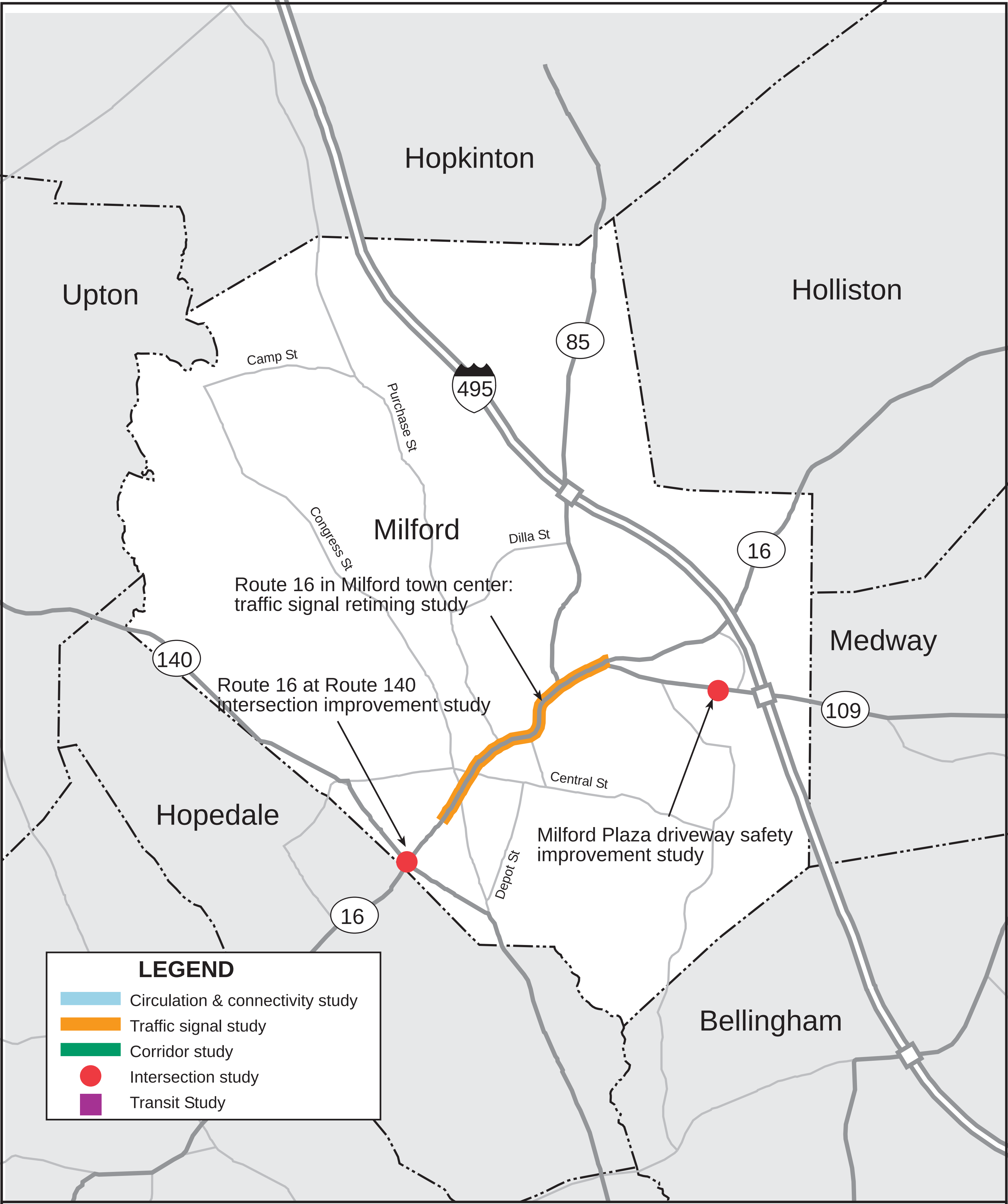


FIGURE ES-6

Milford: Potential Studies and Present Study (Signal Study)

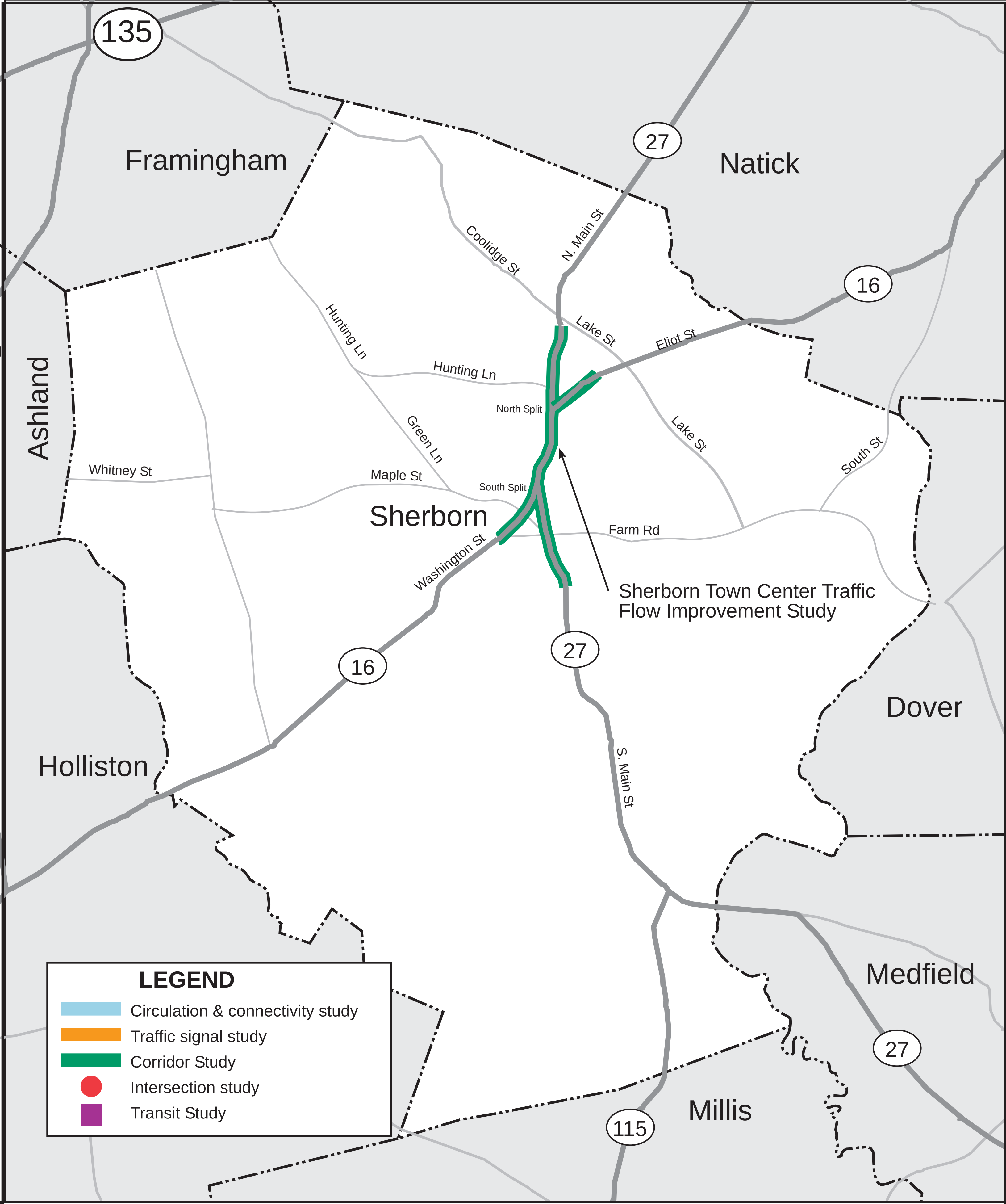


FIGURE ES-7

Sherborn: Present Study

Development and Analysis of Alternatives

In this study, an alternative is a set of measures to address traffic safety, operational, and other problems within the study area. Eight alternatives were developed and analyzed. During the development of the alternatives, MassHighway and the Town of Sherborn reviewed them in their preliminary stages, and the issues they raised were addressed. Some of the alternatives also reflect input given by citizens at a public meeting at which the recommendations of the study were presented (the meeting minutes are provided as Appendix B). Each of the eight alternatives and its improvement measures are described in detail in chapter 3.

To facilitate the presentation of the analysis and the results of the study, the corridor was divided into three sections:

Upper section – From the Lake Street intersection at Route 27 through the North Split
Middle section – Between the North Split and the South Split (excluding them)
Lower section – The South Split and the triangular roadway network south of it

Recommendations

Based on discussions with MassHighway and the Town of Sherborn, including expressions of support from citizens of Sherborn, Alternative 2 is recommended for implementation. Alternative 2 is a package of improvements that include intersection improvements—some of which involve realignment of street approaches—other roadway improvements, installation of a traffic signal at the South Split, and retiming of the existing North Split traffic signal.

Upper Section

Alternative 2's improvements in the upper section, shown in Figure ES-8, would help reduce the chronic congestion, traffic queues, and safety problems at the North Split and at the Lake and Coolidge streets intersections during the AM and PM peak periods. They would enhance traffic operations near Lake and Coolidge by allowing the through traffic to flow with minimal interruptions from the left turns. At the North Split, a red arrow indication has been proposed for the northbound right turn, to end the free right turns when the pedestrian walk light is actuated to improve safety for pedestrians. This alternative prohibits Route 27 southbound left turns at the North Split onto Route 16 eastbound; signs upstream would direct southbound Route 27 traffic headed for Route 16 to use Lake Street or Butler Street. One of the reasons for this prohibition is that currently the left-turning vehicles block the through traffic and use much of the southbound green time looking for gaps in which to turn. At Lake Street or Butler Street, the left-turning vehicles would have adequate gaps created by the existing North Split traffic signal (when Route 27 northbound and southbound approaches have the red indications) to turn without causing queuing.

Middle Section

The improvements for the middle section, shown in Figure ES-9, include widening the roadway to 32 feet in the business center (two 11-foot travel lanes and two 5-foot shoulders). The widened

shoulders would provide space for through vehicles. The increasing business activities in the district can be expected to continue to generate more turning vehicles, and, hence, the potential for even more frequent interruption of the through traffic flow. Providing the widened shoulders would reduce the pressure on the through traffic and prevent potential traffic gridlock in the business center during peak periods. It would also improve traffic safety and be beneficial to pedestrians.

Adding a sidewalk on the east side of Route 16/27 from Village Way to Cemetery Lane would enhance accessibility to the business center, especially for the senior citizens at the Woodhaven elderly housing facility.

The gates and override detector systems that are proposed for the railroad grade crossing would improve safety by preventing entrapment of vehicles on the tracks. Currently, during peak periods, traffic queues extend beyond the railroad grade crossing, a major safety problem.

Lower Section

The improvements for the lower section, shown in Figure ES-10, would be expected to improve traffic operations and safety overall by reducing delays and traffic queues and improving sight distance. They would preserve the existing traffic circulation pattern, enhance access to Village Way through signalization of the South Split, and reduce angle collisions involving Route 27 southbound left turns at the South Split by providing full protection for the turns. An exclusive left-turn bay would prevent the Route 27 southbound lefts from blocking the through traffic. In addition, the installation of preemption signal systems at the South Split that interconnects the override detector systems that is proposed at the railroad grade crossing would serve Route 27 southbound traffic queues upon the approach of a train. Finally, the installation of an Opticom priority system at the South Split will facilitate emergency delivery system.

Impacts

Under Alternative 2, the cross streets of the following intersections would continue to experience unacceptable delays (level of service E or F): Route 16/27 at Powderhouse Lane, Route 16/27 at Cemetery Lane, and Route 16 at Maple Street/Sanger Street. In the AM peak, due to the extremely high volume of northbound traffic at the South Split (1585 vehicles per hour), the intersection would operate at an unacceptable level of service. In the PM peak, the South Split intersection would operate at an acceptable level of service; however, its 2020 level of service would not be acceptable. This alternative does not address congestion at the Route 16/Maple Street intersection, where the cross streets would still experience excessive delays.

Alternative 2 would not limit access to and from Village Way, and to properties south of the South Split (unlike some alternatives that were examined). The alternative would improve accessibility in the business center for both motorists and pedestrians overall. There would be minimal adverse impacts on the environment; they would include tree removal and replanting. Moderate to major traffic disruption would be expected during construction. The cost of implementation is estimated at $2.3 million.

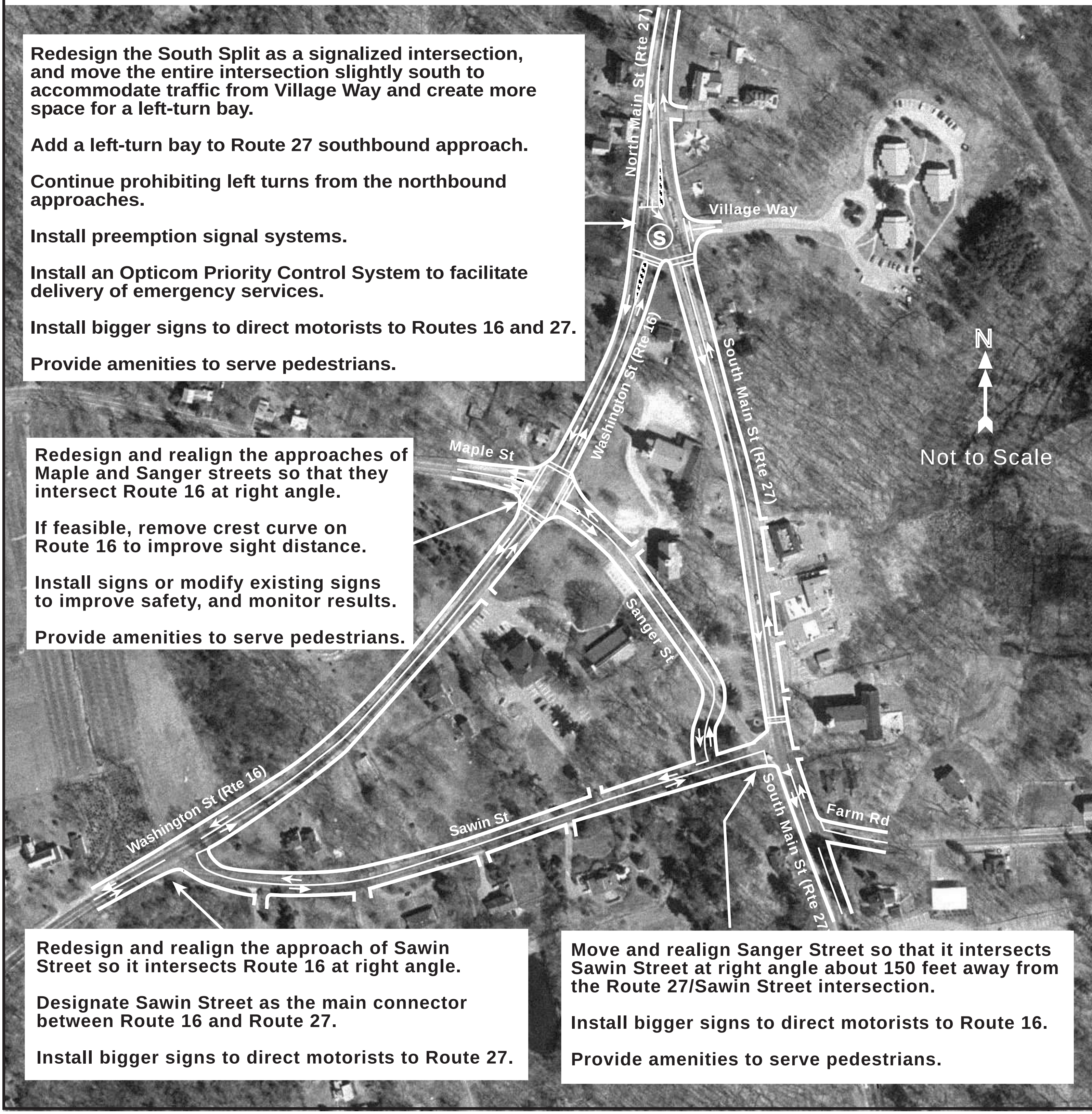
FIGURE ES-8
Alternative 2: Upper Section

FIGURE ES-9

Alternative 2: Middle Section

FIGURE ES-10

Alternative 2: Lower Section



ROUTE 16 IN MILFORD TOWN CENTER: TRAFFIC SIGNAL RETIMING STUDY

The study area encompasses Route 16 in the town center of Milford from Route 109 to Water Street. Route 16 in Milford is a two-way, two-lane arterial under the jurisdiction of the Town. It runs in a generally east/west direction and provides connections from Milford to the I-495 corridor and the MetroWest area.

The primary issue is the high volume of commuter traffic on Route 16 during the morning and afternoon peak periods, which causes long delays and traffic queues in the town center. This congestion affects not only motorists but also the safety of pedestrians. There are seven closely spaced traffic signals within the 1.6-mile study corridor that need improvements to facilitate traffic flow and increase safety. Because Route 16 operates at capacity during peak periods, additional growth in travel will likely bring about expansion of the peak period rather than an increase in peak-hour volumes. The Town of Milford is concerned about the traffic problems on Route 16 and is looking for solutions.

One of the lowest-cost methods of dealing with capacity problems is traffic signal retiming and coordination. It has received increased attention as a cost-effective transportation systems management measure. Results from several studies demonstrate that substantial reductions in delay and stops and considerable energy savings can be achieved through improving timing plans of existing signal systems. The reduction in delay and stops at traffic signals results in travel time savings and increased safety for the public.

Changes in traffic flow patterns caused by changes in land use, population, or roadway or intersection lane configurations may create the need for retiming signals. These changes may result in unnecessary delays and stops, long traffic queues, and poor progression of traffic. As a rule of thumb, one should make field observations every three to five years to determine if signal retiming is necessary.

The objective of this study was to improve traffic operations and safety along Route 16 in the Milford town center area. Preliminary review of the issues indicated that a primary focus should be the potential of optimizing (retiming and coordinating) the existing signal system and providing protection through signal phasing for left turns at intersections where needed.

Existing Conditions

In summary, the existing-conditions analysis indicated that:

1. The high-crash locations are the intersections of Route 16 with Route 109, School and Jefferson streets, Exchange Street, and Congress and South Main streets.

2. All of the signalized intersections met Warrants 2, and 3 in the MUTCD justifying signalization.

3. All of the intersections have one or more movements operating at an unacceptable level of service (LOS E or F).

4. All of the intersections have long traffic queues during the peak periods.

5. The arterial travel speed is worst (LOS F) during the PM peak hour in the westbound direction, when vehicles travel at 6 mph. During the same period, the eastbound vehicles travel at 16 mph (LOS C).

6. During the AM peak hour, the westbound vehicles travel at 16 mph (LOS C), while the eastbound vehicles travel at 10 mph (LOS D).

7. The lane configurations at the intersections cannot be significantly improved, given the lack of space for widening.

Optimization of the Traffic Signal System

After evaluating the existing conditions, five criteria were used to assess the desirability of coordinating the intersections' traffic signals. The assessment indicated that coordination is warranted and could be expected to reduce delays, the number of stops, and therefore, fuel consumption.

SYNCHRO 5.0 software was used to optimize the traffic signal timings and phasing for coordination and other possible benefits. Most of the data needed for the optimization runs was already coded for the evaluation of existing conditions; therefore parameters were selectively changed by editing the existing-conditions data. The process was iterative; that is, it required several simulation runs, optimizing with both existing phasing and new phasing plans.

A number of changes to the existing signal system were developed. The signals were given optimized cycle lengths, splits, and offsets for coordination. The final design that was developed is shown in Figure ES-11. For coordination purposes, the optimized cycle lengths of all the signals in the system should be the same (or some multiple), to establish a time relationship between the beginning of the arterial green at one intersection and the beginning of the arterial green at the next intersection. The cycle lengths proposed for all of the intersections are 100 seconds for the AM peak period and 110 seconds for the PM peak period.

Estimated Benefits of the Optimized Traffic System

To quantify benefits, a comparison was made between the optimized and the existing traffic signal systems. The primary measures of effectiveness used in this before-and-after analysis were total delay savings, total stop reductions, increase in arterial speeds, and fuel savings.

In summary, retiming the signals would improve traffic operations on Route 16, providing estimated overall reductions in traffic delays of 33%, in stops of 28%, and in fuel consumption of 25%. The analysis shows little or no change in the arterial speed (0–1 mph) except for the PM peak westbound, where the average speed would increase from 6 mph to 10 mph. If the optimized signal system is implemented, its effectiveness should be evaluated through the monitoring of traffic operations.

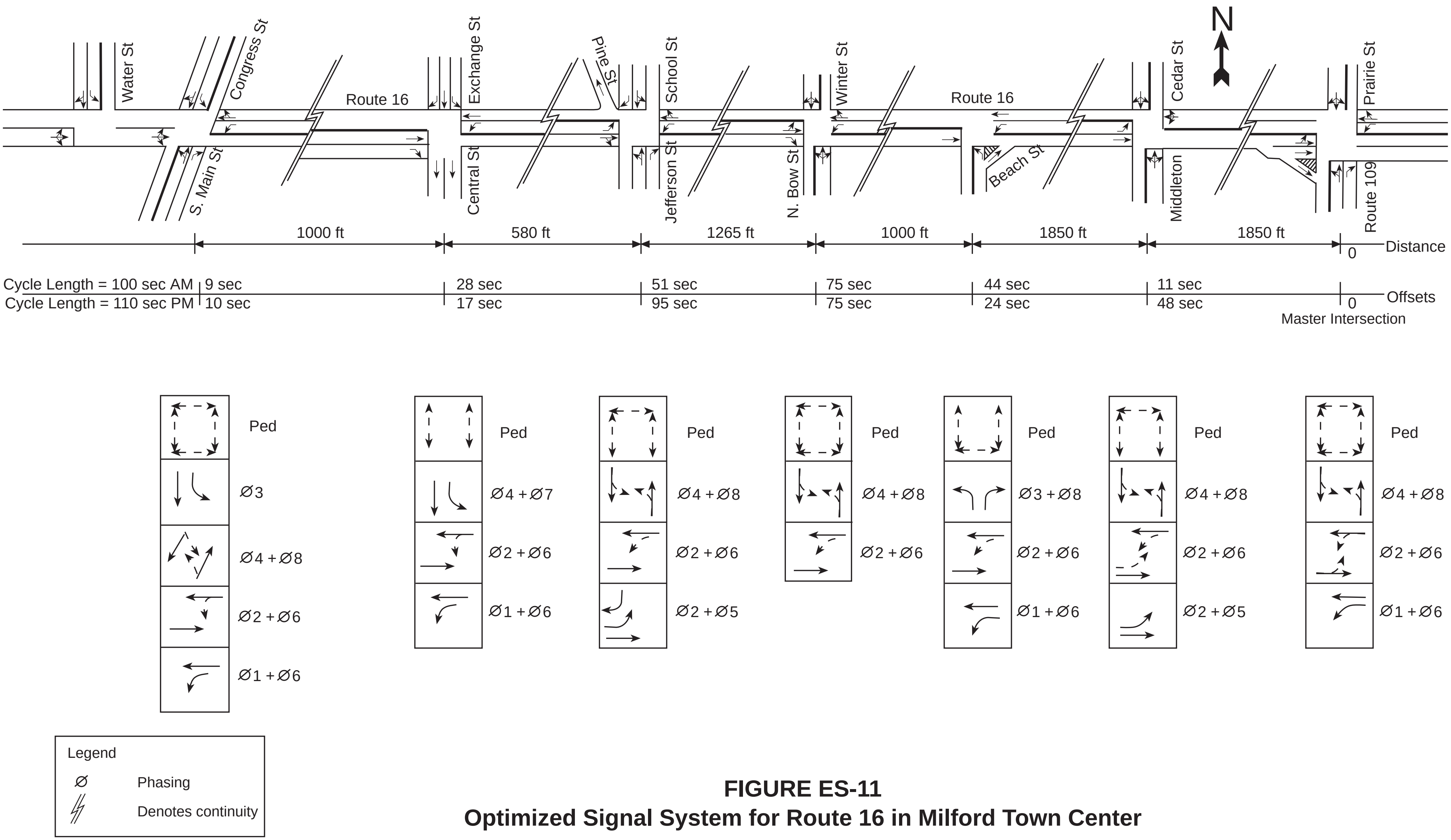


FIGURE ES-11
Optimized Signal System for Route 16 in Milford Town Center

While the retiming and coordination of the signals have moderate benefits, they would not resolve all the traffic problems in the corridor, because of the high traffic volumes. The handling of the school crossing at Beach Street is also a factor. The analysis indicated that congestion at the intersections of Route 109 and Route 85 would persist during the PM peak period due to the high traffic volumes. At the Beach Street intersection during the AM and PM school peak periods, the effectiveness of the coordination of the signals would be impaired, assuming that the use of the school crossing continues to be conducted in the current manner.

An additional travel lane in each direction would be required on Route 16 to enable it to handle the peak period traffic volumes without congestion. Since there is not sufficient available space in the Route 16 corridor for roadway widening, it is suggested that the Town revisit the recommendation of the 1979 planning study by Harvard University. That study recommended creation of an alternative route running along the Penn Central Railroad right-of-way, paralleling Route 16, from Route 109 to Central Street. Such an alternative route would increase the east-west traffic capacity through Milford without adding lanes to Route 16.